

REMARKS

Upon entry of this Amendment, claims 18-45 will be all the claims pending in the application. Claims 5 and 30 have been amended to recite an upper limit of the amount of carbon fiber of 5 mass%. Support for the amendment is found, for example in Table 1 at page 46 of the specification. Claims 18-29, 35-37, 39 and 40 are withdrawn from consideration as being directed to a non-elected invention.

Review and reconsideration on the merits are requested.

Claim Rejections under 35 U.S.C. § 112

Claims 5 and 30 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. The Examiner asserts that claims 5 and 30 recite an amount of carbon fiber of 0.2 to 20 mass%, which is broader than the limitation in independent claim 1.

In response, claims 5 and 30 have been amended to recite an upper limit of the amount of carbon fiber of 5 mass%.

It is respectfully submitted that the claims as amended fully comply with 35 U.S.C. § 112, and withdrawal of the rejections are respectfully requested.

Claim Rejections under 35 U.S.C. § 103 based on Ochoa

Claims 1, 5, 6, 8, 30-33, 38 and 42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ochoa et al. (U.S. Patent Application Publication No. 2003/0099883) ("Ochoa").

The rejection should be withdrawn for at least the following reasons.

The present invention is distinct from Ochoa in that (1) Ochoa uses carbon fiber as the negative electrode active substance whereas the present invention calls for a negative electrode active substance in addition to carbon fiber; and (2) Ochoa does not disclose, teach, or suggest an electrode having a porosity of 25% or less.

(1) Ochoa uses 89% by weight or more of carbon fiber as the negative electrode active substance and 0.1 to 1% by weight of carbon nanotubes as an additive. *See* Tables 3 and 4 and paragraph [0018] of Ochoa. In paragraph 8, page 4, of the Office Action, the Examiner appears to have misconstrued the carbon black of Ochoa as the electrode active substance. Tables 3 and 4 and paragraph [0018] of Ochoa show that carbon fiber is the active substance, whereas carbon black and carbon nanotube are the additives.

Thus, not only is the negative electrode active substance of Ochoa substantially different from the negative electrode active substance of the present invention, Ochoa uses a substantially high amount of carbon fiber as the negative electrode active material, and a substantially small amount of carbon nanotubes as an additive. One of ordinary skill in the art can easily recognize that an electrode using a carbon material including graphite particles and non-graphite particles as the negative electrode active substance would have different battery properties than an electrode using carbon fiber as the negative electrode active substance.

(2) Second, Ochoa at least does not disclose, teach, or suggest an electrode having a low porosity of 25% or less. Moreover, Ochoa teaches away from an electrode having a low porosity of 25% or less. While an object of the present invention is to decrease the porosity in order to obtain a high density while maintaining little reduction in the electrolytic solution permeability

(see page 5 of the present specification), Ochoa discloses in paragraph [0017] that “[i]ncreasing porosity to lower thermoelectrical conductivity is preferable due to the ease of manufacture” (emphasis added). When attempting to lower the porosity of an electrode, one would necessarily need to balance the low porosity and permeability of the electrolytic solution. As stated on page 3 of the present specification, as the porosity decreases, problems including a reduction in electrolytic solution permeability would occur. Thus, one of ordinary skill in the art would not normally seek to lower the porosity of an electrode to 25% or less. Ochoa does not contemplate lowering the porosity of the electrode to 25% or less, but instead encourages an increase of porosity in the electrode in order to make the method of manufacturing easier.

Further, the porosity in Ochoa is substantially higher than 25%. The porosity of the electrode of Ochoa can be calculated based on the composition and the density of 3.2 g/cm^3 of the positive electrode disclosed in paragraph [0021] of Ochoa. Ochoa discloses in Table 1 the density of each of the materials used in manufacturing the electrode. The density values disclosed in Table 1 of Ochoa appear to be the true density values, and the porosity was calculated based on the assumption that the density values in Table 1 of Ochoa are the true density values.

As for the blend ratio, as the table below shows, the porosity was calculated using the mass ratio of the materials of cathode #1 in Table 4 of Ochoa because cathode #1 is an example where SWCNT is added.

| | True density g/cm ³ | Blend ratio wt % |
|--------------------|-----------------------------------|---------------------|
| SWCNT | 1.4 | 0.50 |
| PVDF | 1.77 | 3.90 |
| LiCoO ₂ | 5.01 | 91.5 |
| KS-6 | 2.26 | 4.15 |

The weighted average true density is 4.75 g/cm³ (= 0.210 cm³/g). Meanwhile, since the electrode as taught by Ochoa has a density of 3.2 g/cm³ (0.3125 g/cm³), the porosity is calculated to be 32.7 vol%. Even though the porosity was calculated based on the assumption that the density values in Table 1 of Ochoa are the true density values, the resulting porosity would hardly change even if the density of SWCNT somewhat varies.

For the above reasons, it is respectfully submitted that the rejected claims are patentable over the cited prior art, and withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

Claim Rejections under 35 U.S.C. § 103 based on Frysz

Claims 1, 3, 5, 6, and 30-34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Frysz et al ("Carbon filaments as a conductive additive to the manganese dioxide cathode of a lithium electrolytic cell"; Journal of Power Sources; Vol. 58; 1996; pp. 41-54), in view of Nishimura et al. (European Application No. EP 1191131).

The rejection should be withdrawn for the following reasons.

The present invention is distinct from Frysz because Frysz at least does not disclose, teach, or suggest an electrode having a porosity of 25% or less. Further, as discussed below,

Nishimura also does not disclose, teach or suggest an electrode having a porosity of 25% or less, and thus does not make up for the deficiencies of Frysz.

As stated above, as porosity decreases, problems including a reduction in electrolytic solution permeability arise. Thus, one of ordinary skill in the art would not normally seek to lower the porosity of an electrode to 25% or less. Frysz does not contemplate lowering the porosity of the electrode to 25% or less. Instead, the electrode of Frysz has a porosity that is substantially higher than 25%.

The porosity of the electrode of Frysz can be calculated under the conditions in which the maximum electrode density is provided within the range disclosed in Frysz and using 2.16 g/cm³ as the true density of the Teflon binder. See page 3, Table 1, of the attached copy of DuPont's product information for "Teflon PTFE 7A". The results of the calculation are shown in the table below.

| | True density g/cm ³ | Blend ratio wt% |
|------------------|-----------------------------------|--------------------|
| ADNH | 2.0 | 8.2 |
| MnO ₂ | 5.0 | 82.0 |
| Teflon | 2.16 | 9.8 |

The weighted average true density is 4.48 g/cm³ (= 0.2234 cm³/g). Meanwhile, since the maximum electrode density disclosed by Frysz is 2.31 g/cm³ (0.4329 g/cm³) (see Table 1 of Frysz), the porosity is calculated to be 48.4 vol%. Thus, the porosity disclosed by Frysz is substantially higher than 25 vol%, and one of ordinary skill in the art would not have arrived at the present invention having a porosity of 25 vol% or less based on the disclosure of Frysz.

Claim Rejections under 35 U.S.C. § 103(a) based on Nishimura

Claims 1, 2, 4-9, 30, 32-34, 38, 42 and 43 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa.

Claims 3 and 45 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa as applied to claims 1, 2, 4-9, 30, 32-34, 38, 42 and 43 above, and further in view of Frysz.

Claim 31 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa as applied to claims 1, 2, 4-9, 30, 32-34, 38, 42 and 43 above, or alternatively under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa and Frysz.

Claims 41 and 44 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa as applied to claims 1, 2, 4-9, 30, 32-34, 38, 42 and 43 above, and further in view of Kubota et al. (U.S. Patent No. 6,139,990).

Claim 45 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishimura in view of Ochoa as applied to claims 1, 2, 4-9, 30, 32-34, 38, 42 and 43 above, and further in view of Kitagawa et al. (U.S. Patent Application Publication No. US 2002/0061445).

The above rejections citing Nishimura as a primary reference should be withdrawn for the following reasons.

The present invention is distinct from Nishimura because Nishimura, and also the secondary references do not disclose, either explicitly or inherently, an electrode having a porosity of 25% or less. Namely, Nishimura does not disclose any specific values for the

porosity of the electrode. Further, as shown above, Ochoa and Frysz also do not disclose an electrode porosity of 25% or less as claimed.

Nishimura also does not *inherently* disclose an electrode porosity of 25% or less. This is because an electrode having a porosity of 25% or less cannot be produced without intentionally pressing to fabricate the electrode, whereas an electrode produced according to conventional methods cannot attain a porosity of 25% or less. Even in Ochoa and Frysz which sought to lower the porosity, the porosity was at a level of 33-48 vol%. In Example 7 of Nishimura, PVDF is added to 100% of carbon fiber. Since the carbon fiber has a high bulk density, it is very difficult to increase the electrode density. Therefore, it is unlikely that the density of the electrode of Nishimura had a porosity of 25% or less as claimed in present claim 1. Accordingly, the working examples of Nishimura do not inherently meet the claimed high-density electrode, and one of ordinary skill could not arrive at the constituent requirements of the invention even by combining Nishimura with Ochoa and Frysz.

Withdrawal of the foregoing rejections under 35 U.S.C. § 103(a) is respectfully requested.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. No.: 10/565,302

Attorney Docket No.: Q76805

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

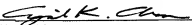
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23373

CUSTOMER NUMBER

Date: May 10, 2011


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Teflon® PTFE 7A

fluoropolymer resin

Granular Compression Molding Resin

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Description

Teflon® PTFE 7A is a white powder with very small particle size. Its most unique feature is high bulk density.

The small particle size of *Teflon*® PTFE 7A helps to minimize voids even at relatively low molding pressure. High bulk density increases the size of moldings possible from a given mold or press opening.

Teflon® PTFE 7A is preferred for large moldings, such as billets, requiring optimum mechanical and electrical properties. It is also used in a mixture with fillers when they are added to modify the mechanical properties of moldings.

Properly processed products made from neat *Teflon*® PTFE 7A provide the superior properties typical of the fluoropolymer resins: retention of properties after service at 260°C (500°F), useful properties at -240°C (-400°F), chemical inertness to nearly all industrial chemicals and solvents, and

low friction and antistick surfaces. Dielectric properties are outstanding and stable with frequency and temperature. Molded products have moderate stiffness and high ultimate elongation.

In a flame situation, products of *Teflon*® PTFE 7A resist ignition and do not themselves promote flame spread. When ignited by flame from other sources, their contribution of heat is small and with very little smoke.

Statements, or data, regarding behavior in a flame situation are not intended to reflect hazards presented by this or any other material when under actual fire conditions.

Typical End Products

Many end products are fabricated from moldings of *Teflon*® PTFE 7A, including skived film and sheet, gaskets, packings, mechanical seals, bridge or pipeline bearing pads, shaft bearings, electrical insulators, piston rings, expansion bellows, diaphragms, and chemical linings. The use of fillers provides a wide choice of modified mechanical properties.

FDA Compliance

Properly processed products (sintered at high temperatures common to the industry) made from *Teflon*® PTFE 7A resin can qualify for use in contact with food in compliance with FDA Regulation 21 CFR 177.1550.

Processing

Teflon® PTFE 7A usually is processed in two steps: preforming and sintering. The powder is first compacted into a preformed shape approximating that of the desired molding. A precise heating (sintering) and cooling cycle is then used to consolidate the molding at temperatures above the crystalline melting point of the neat powder. The properties of a finished molding are dependent on preform pressure, sintering time and temperature, and cooling rate.

Teflon® PTFE 7A is used to make relatively large objects in molds that can be filled manually. Small-particle resins do not flow properly in automatic feeding systems. Refer to the typical property data in Table 1.

Safety Precautions

WARNING!

VAPORS CAN BE LIBERATED THAT MAY BE HAZARDOUS IF INHALED.

Before using *Teflon*® PTFE 7A, read the Material Safety Data Sheet and the detailed information in the "Guide to the Safe Handling of Fluoropolymer Resins," latest edition, published by the Fluoropolymers Division of The Society of the Plastics Industry—available from DuPont.

Open and use containers only in well-ventilated areas using local exhaust ventilation (LEV). Vapors and fumes liberated during hot processing, or from smoking tobacco or cigarettes contaminated with *Teflon*® PTFE 7A, may cause flu-like symptoms (chills, fever, sore throat) that may not occur until several hours after exposure and that typically pass within about 24 hours. Vapors and fumes liberated during hot processing should be exhausted completely from the work area; contamination of tobacco with polymers should be avoided.

Mixtures with some finely divided metals, such as magnesium or aluminum, can be flammable or explosive under some conditions.

Storage and Handling

Preforming is easiest when the resin is uniformly between 21–27°C (70–80°F). As temperature declines below this range, the resin will be increasingly difficult to mold without cracks and problems with condensed moisture. Higher temperatures inhibit flow and promote lumping. Storage conditions should be set accordingly.

Cleanliness is a critical requirement for successful use of *Teflon*® PTFE 7A. The white resin and high sintering temperatures cause even very small foreign particles to become visible in finished moldings. Keep resin drums closed and clean. Good housekeeping and careful handling are essential.

Table 1
Typical Property Data for *Teflon*® PTFE Fluoropolymer Resin Grade 7A*

| Property | ASTM Test Method | Unit | Nominal Value |
|---|------------------|------------|----------------------|
| General | | | |
| Average Bulk Density | D4894 | g/L | 460 |
| Average Mold Shrinkage (at preform pressure of 35 MPa [5,000 psi]) | D4894 | % | 3.4 |
| Average Particle Size | D4894 | μm | 34 |
| Standard Specific Gravity | D4894 | — | 2.16 |
| Melting, Peak Temperature | D4894 | | |
| Initial | | °C (°F) | 342 ±10 (648 ±18) |
| Second | | °C (°F) | 327 ±10 (621 ±18) |
| Mechanical | | | |
| Tensile Strength | D4894 | MPa (psi) | 34.5 (5,000) |
| Elongation at Break | D4894 | % | 375 |

* *Teflon*® PTFE 7A is ASTM D4894, Type II.

Note: Typical properties are not suitable for specification purposes.

Freight Classification

Teflon® PTFE 7A, when shipped by rail or express, is classified "Plastics, Synthetic, O.T.L., NOIBN." Resin shipped by truck is classified "Plastics, Materials Granules."

Packaging

Teflon® PTFE 7A is packaged in 100-lb (45-kg) drums. Each drum has a bag liner made of polyethylene resin.

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